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A SUGGESTION FOR SUMMER OBSERVATIONS.

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(Plates 97 to 99.)

INCOMPLETE and imperfect observations on any subject do not enhance the observer's scientific reputation, but they are perhaps of worth by calling to the subject the attention of those whose studies may be of more value. And in the case of grass anthesis, if many persons should happen to make notes on the same grass species, their notes, if agreeing, will give us fixed rules, or, if differing, will show us range of variation in the flowering habits of the species.

With this apology, I offer the result of my own desultory examinations, made in the summer of 1911, having been incited thereto by reading for the first time that, in grasses, "The opening of the flowers caused by the divergence of the two glumes is effected by the lodicules. They become fleshy and succulent and usually spheroidally swollen at base, by means of which they overcome the resistance of the elastic outer glume and move it outward. After fading, which occurs at latest in one to two hours, they shrivel up again into small, thin leaves."

This closing again in "one to two hours" must be one of the hundred lies a lecturer has to tell to make his story straight.¹ Probably it is true for most species, but in *Arrhenatherum elatius* I noted two individual spikelets, the flowers of which kept open twenty-four hours; and two flowers in a marked spikelet of *Poa annua* kept open six hours

¹ A distinguished lecturer at Wood's Hole once remarked: "I never make a straight story in my lecture without feeling I have told a hundred lies."

— both of these, however, were in the house, though the *Poa* was growing in earth. The true test would be to mark individual flowers in natural conditions out of doors — paint, or waterproof ink might be used.

Poa annua is a grass always “on tap.” I found the first open flower this year (1912) on April 28, and it will keep in bloom until late fall, and then may be potted and will flower through the winter in the house, while as to time of day, I have found blossoms open out of doors from 3 A. M. (before light) to 6 P. M.¹

One often finds grass flowers open and not a grain of pollen left in the anthers, which then usually resemble two empty canoes placed back to back. Grasses are wind-fertilized, and Hackel states that they are “usually protandrous, more rarely protogynous (*Alopecurus*, *Anthoxanthum*, *Spartina*)” “The anthers empty most of the pollen at once by turning completely over; when the stigmas project laterally from the pendulous or nodding spikelet they turn upward, and thus are only dusted with the pollen of flowers situated above. Rarely they project from the tip of the spikelet. This occurs in protogynous or monoecious species. The glumes in species of *Alopecurus*, *Anthoxanthum*, *Phalaris* and *Phleum* open scarcely or not at all during anthesis. In these cases, stigmas and anthers project through a narrow slit.”

If I had read the above at the beginning of the summer, it would have saved me many fruitless efforts to find open flowers of *Phleum*. Neither did I find any in *Spartina*, but I found anthers shedding pollen in abundance out of doors, at 10.30 A. M. on a sunny day, and once, bringing a dew-soaked inflorescence into the house at 6 A. M., it shook out the pollen at 10, when the dew had dried.

But the most drenching dew does not seem to hinder the pollen of *Ammophila arenaria* from flying in thick clouds: I found it thus on Aug. 23 at 6.15 A. M. An hour later, returning from my walk, I found the usually trim, terete inflorescence looking positively ragged with the many gaping mouths of the flowers up and down the spikes, the pollen not being all shed, though examining spikes as late as 9 A. M. I found the anthers quite empty. A quotation given by Kunth says “the stigmatic branches do not protrude, and are receptive within

¹ But it flowers most profusely in the early morning — one day in June, at 5 A. M., I counted, on the panicles borne by one root of *Poa annua*, 30 open flowers, there being usually two in the same spikelet.

the still closed glumes, while the undehisced anthers already project slightly from their tips." I did not find the flowers to open readily in the house, though my drawing of the lodicules was made from a spike in a vase [at 6.30 A. M.].

But flowers of *Festuca elatior* do open readily in the house — I noted them at 6, 7 and 8 A. M. and at noon, and those of *Agropyron repens* at 10.30 and 3.30; and out of doors I found them open at 5.30 P. M., back of Magnolia Beach, on a cool, gray day.

The anthesis and pollination of *Arrhenatherum elatius* is fully pictured and described in Kunth, but I was glad to find two panicles, and to see for myself the large lodicules, with unusually long tops.

Elymus virginicus is common at Magnolia, along Raymond St., but through some piece of carelessness, having forgotten the results of previous determinations, I last summer brought it out to *E. canadensis*. Finding flowers open, in a vase in the house at 4 P. M., I drew the lodicules with the scale-like tops fringed. Later, I looked up the Latin description of various lodicules in Kunth's *Enumeratio Plantarum*, and noticed that he called those of *Elymus canadensis* "non-ciliatae," and those of *E. virginicus*, "ciliatae"; I then compared my Raymond St. plants with previously named mounts in my herbarium, and found them to be really *E. virginicus*.

Oats — *Avena sativa*, grew abundantly by stables and roadsides at Magnolia, and as I passed them, at all hours of the day, I gathered the pretty panicles and looked for open flowers, also standing them in vases about the house, but I never caught a blossom open till the morning of September 12, at 6 A. M., when my eye was caught by one open blossom in a glass in the house, with turgescient lodicules, and a half-split anther caught onto one stigma. But if American-grown Oats behave like European, there seems no reason why I should not have found flowers open very often. Out of a number of observers quoted by Kunth, Godron states that the flowers open between 2 and 4 P. M.; Hildebrand that in dry weather, they open in the afternoon or towards evening, but in unfavorable weather, they remain closed, and pseudo-cleistogamous autogamy takes place; Kirchener says that anthesis begins in the afternoon when the weather is favorable and lasts till evening; Körnicke says, many varieties, besides opening in the P. M. do so also in the A. M. beginning in favorable weather, before 8 A. M. and continuing some hours, but the bulk of the flowers always open after mid-day. De Vries tells us that

“Wheat, barley and oats are self-fertile and do not mix in the field through cross-pollination.”

In grass-species that are the same as those of Europe, I look with interest to see if the hours of anthesis given for Europe are the same in America; Kunth names 11 A. M. for *Agrostis*, and on Copley Square at that hour, I gathered a panicle of *Agrostis alba* with open flowers, and taking it to a Botany Class, we had the satisfaction of seeing the tiny, but turgescient lodicules. The much-observed *Dactylis glomerata* is said by one man to open at 6 and 7, by another man, 6 and 9; here, I have found them at 6 and 7 A. M.

By the end of the summer, I had examined only nine or ten of the turgescient lodicules of grass-species belonging to the Sub-family *Poacoideae*, and four or five belonging to that of the *Panicoideae*, an insufficient basis for a theory, yet I noticed that the lodicules of the former had thin, scale-like tops to their turgescient bases, while of the latter the lodicules of *Setaria verticillata*, *Digitaria humifusa* and *D. sanguinalis* were like pebbles, round or oblong, while those of *Echinochloa crus-galli* were broad, and square at the top; fortunately remembering that Dr. Percival Lowell tells us that “nothing is so rash as a general denial, except a particular statement,” I looked in Kunth’s drawings of lodicules in *Enumeratio plantarum*, and there found two or three of the *Poacoideae* that had truncate tops, not tapering up into a lanceolate tip — these were the “squamulae in unam connatae” of *Glyceria aquatica* and *Glyceria fluitans*, and the squamulae with ciliate tops of *Andropogon halepensis*.

I found the flowers of *Setaria verticillata* and *S. glauca* open in July at about 6 A. M.; those of *Digitaria humifusa* I found open from 4 to 5 A. M., but think they were all closed by 7 — that, however, was on an intensely hot day (July 4, 1911). From 7 to 8 A. M. the little mouths of *Digitaria sanguinalis* open up and down the freshly emerged “fingers” that have scarcely begun to separate from each other. A quotation from Knuth informs us that the “stigmas protrude simultaneously with the anthers, so that at first only self-pollination is possible.” I noticed that the neutral flower has as well-developed turgescient lodicules as the perfect flower.

Flowers of *Echinochloa crus-galli* I found open, in the house, from 8 to 9 A. M., with lodicules so different from those of any other grass-species that I have examined, that I shall seek for the earliest blooming panicle this year, to verify my drawings.

Although to see the lodicules thoroughly requires a compound microscope (binocular preferable) a hand-lens shows their presence, and enables one also to make accurate and useful observations as to hours of anthesis, duration of anthesis, time required for emptying the anthers, and facts about the stigmas. A folding chart might be made of paper ruled in squares, with the hours and half-hours of the day on top, and names of grass-species observed, on the left side, with space for notes as to whether the atmosphere is dry or damp. A v might represent an open flower, dots stand for pollen being shed, and a fringed line represent stigmas in good condition.— suggestions upon which students will soon learn to improve.

NOTE: When I wrote the above account of my last summer's observations on grass anthesis, I hoped it would appear early enough in the season to suggest to others to investigate the interesting subject for themselves. I fear that by the end of September, there will not be many grass-species in bloom, but I am sincerely glad of a delay which enables me to add some of the results of my more recent observations, extending, modifying or reversing those of last year.

I stated that *Poa annua* can be found in bloom at any hour of the day, but I find that by far the greater number of blossoms open in the early morning, say from 3 to 7 A. M. On one plant in my border, I counted about 30 spikelets with open flowers — 2 or 3 in each spikelet.

Last summer, I only once found an oat blossom open; this year, I have found them open often, both in a vase in the house, and out of doors,— the latter was in the afternoon.

Last year I found no open flowers of *Glyceria canadensis*; this year, I found many; the time was 7 A. M. on July 6th. I have also examined the lodicules of *Glyceria grandis*, *G. borealis*, *G. acutiflora* and *G. pallida*, all of which species grow at Magnolia, though I do not remember seeing *G. grandis* here before this summer. The lodicules and stigmas of *G. pallida* I could not distinguish from those of *Poa annua*, but the other four have stigmas differing from the usual grass-type, and lodicules square-topped, that is, no uninflated scale-like top. Sometimes, under the microscope, they take the form of those "bracket-fungi" that grow on tree-trunks. I found *Glyceria pallida* with open flowers at 11 A. M.; in the afternoon, many more opened in a vase in the house, and next morning, several were open, the pretty red-brown anthers contrasting pleasingly with the pale green of the spikelets.

The lodicules of *Danthonia spicata* are also of the square-topped type. I found flowers open on July 2nd, at 10 A. M.

When a grass-species begins to bloom, the flowers at the top of the panicle open first, but if the spikelets are many-flowered, anthesis begins with the lowest flower in each spikelet; when each little mouth is closed again, the shrivelled anthers are left outside, so that one can usually tell, by looking at a spike or panicle, even if no flowers are open, whether the plant is coming into bloom or passing out of bloom. On August 14th, I brought home a few young culms of *Andropogon furcatus*; next morning a row of from 4 to 8 little mouths was open in the upper part of each spike, a curling stigma protruded on each side, and a fringe of pendulous golden anthers (3 from each flower) contrasted with the gray and purple color of the grass. Here again I found the flat-topped type of lodicule, the pair meeting in front and then each extending back along the side of the ovary. The pollen was shaken out between 6 and 8 A. M. I have only seen grass-pollen fly in clouds when the grass is touched or jarred,— whether it appears in a visible cloud when the grass is blown upon by the wind, I do not know.

Some grasses seem to open all their flowers at once — *Deschampsia flexuosa*, for instance. On July 3rd at 7 A. M. I found a panicle on which all but one or two flowers were wide open. I suppose that accounts for the species passing by so quickly. *Arrhenatherum*, of which there was an abundance here, this season (1912) also passed all too quickly through its blooming period, and so did *Calamagrostis canadensis*, and many other grasses; per contra *Glyceria pallida* has been in bloom 7 weeks already.

I have examined turgescient lodicules of various species of *Panicum*, e. g., *P. latifolium*, *P. virgatum*, *P. agrostoides*, and *P. capillare*, and find the general plan the same, curving in front, with a flattish top, and a projection extending backward on each side of the ovary, part of each lodicule being outside the edge of the palet and part inside. Kunth describes the lodicules of *P. virgatum* as follows — “Squamulae duae, late cuneatae, apice oblique truncatae et sinuatae subbilobae glabrae, ovario triplo breviores.” I found this handsome species at Manchester, Mass., not far from the R. R. Station, growing near salt water; at noon, Aug. 13th, a warm, sunny day, many flowers were open, and on the panicles I took home, I could find a few open flowers all through the next day, though the most abundant anthesis was about

noon (some of the open flowers were the staminate ones, some the fertile). Each had its pair of lodicules; but on the third day, the flowers did not open so well. I notice that grasses with hard, stiff culms do not open their flowers well in the house.

As lodicules lie between the ovary and the lemma, to see them well I turn the lemma back against the pedicel, nip the two in stage forceps and put them under the inch objective of my binocular; then I can twist and turn them about, their appearance varying much according to the angle from which one regards them, also according to degree of turgescence; perhaps this explains why the lodicules of *Digitaria sanguinalis* do not look to me this year as I drew them last year! Then they looked to me like round pebbles, and now they appear square-cornered! But that the neutral flower has a pair of them as well as the fertile, remains an uncontrovertible fact.

BOSTON, MASSACHUSETTS.

EXPLANATION OF PLATES.

PLATE 97.

1. *Poa annua*, lodicules, stamens and stigmas, as seen in the bud.
2. *Poa annua*, lodicules and ovary, in the open flower; one stamen left, with an empty anther; Nov. 17th, 5 A. M. (in pot in house).
3. *Poa annua*, lodicules reduced to scales again; grain nearly ripe; anthers and dried-up stigmas pushed to top of flower.
4. *Festuca elatior*, with turgescient lodicules, ovary, one stamen, and base of two other filaments and of the two styles; Aug. 12th, 7.30 A. M.
5. *Avena*, turgescient lodicules, bristly ovary, base of the two stigmas, with one partly-dehisced anther caught onto one of them; Sept. 12th, 6 A. M.
6. *Ammophila arenaria*, turgescient lodicules; Aug. 20th, 6.30 A. M.
7. *Arrhenatherum elatius*, turgescient lodicules; Aug. 22nd, 10.30 A. M.
8. *Elymus virginicus*, turgescient lodicules; Aug. 6, 4 P. M.

PLATE 98.

1. *Setaria verticillata*, cluster of four spikelets, flowers more or less open.
2. *Setaria verticillata*, part of single spikelet, showing turgescient lodicules, styles, stigmas, two anthers, and a bristle; July 6th, 5.30 A. M.
3. *Echinochloa crus-galli*, turgescient lodicules, ovary, bases of two styles, three filaments and the palet; Sept. 16th, 8 A. M.
4. *Echinochloa crus-galli*, a soaked-out flower bud; shows two young, scale-like lodicules, two young stamens, and base of palet.
5. *Digitaria sanguinalis*, turgescient lodicules, etc.; Sept. 12th, 8 A. M.
6. *Digitaria humifusa*, part of spikelet, turgescient lodicules, styles, stigmas, and three empty anthers; July 4th, 5 A. M.
7. *Digitaria humifusa*, part of a raceme, with spikelets more or less open, showing anthers and stigmas.

PLATE 99.

1. *Glyceria acutiflora*, lodicules, united into one; ovary, and base of palet; July 2nd, 6 A. M.
2. *Glyceria grandis*, united lodicules, ovary, styles, and base of curious stigmas; July 15th, 5 A. M.
3. *Glyceria canadensis*, ovary, lodicules and base of palet; July 6th, 7 A. M.
4. *Glyceria pallida*, lodicules, ovary and base of palet; July 7th, 4 P. M.
5. *Danthonia spicata*, lodicules, ovary and base of palet; July 2nd, 10 A. M.
6. The same, side view.
7. *Distichlis spicata*; staminate flower; lodicules, base of palet and of the 3 filaments. Aug. 14th (hour not recorded).
8. *Andropogon furcatus*, base of palet, and lodicules embracing the ovary, viewed from above; Aug. 14th, 9 A. M.
9. *Andropogon furcatus*, lodicules, and ovary viewed from the rear or palet-side;
- 10, 11, and 12. *Panicum capillare*, ovary, lodicules and palet, from different points of view; 10 to 11 A. M.

NOMENCLATORIAL CHANGES REQUIRED BY SOME
GRAMINEAE OF THE SEVENTH EDITION
OF GRAY'S MANUAL.

(Continued from page 173.)

F. TRACY HUBBARD.

PANICUM SCRIBNERIANUM Nash.

Section V, Canon 16, upholds this name when the American Code is followed, but according to Sect. 7, Art. 50 of the "Vienna Code" *P. macrocarpon* Le Conte in Torr. Cat. Pl. N. Y. 91 (1819) which equals *P. latifolium* L. Sp. Pl. 58 (1753) [Cf. Hitchc. & Chase Contr. Nat. Herb. 15 : 314 (1910)] does not render invalid *P. macrocarpon* Torr. Fl. No. & Mid. U. S. 143 (1824), which is the oldest name of the species [cf. Hitchc. & Chase l. c. 283 (1910)]. Consequently *P. Scribnerianum* Nash becomes *P. macrocarpon* Torr.

PANICUM MACROCARPON Torr. Fl. No. & Mid. U. S. 143 (1824) not Le Conte l. c. (1819). Synonymy in part. *P. Scribnerianum* Nash Bull. Torr. Bot. Cl. 22 : 421 (1895); Hitchc. in Gray Man. ed. 7, 115 (1908); Hitchc. & Chase Contr. Nat. Herb. 15 : 283 (1910).

For complete synonymy cf. Hitchc. & Chase l. c.